

Claims

1. A tunnel diode comprising:

- (a) an emitter electrode, in contact with
- (b) a porous material, in contact with
- (c) a collector electrode

wherein said porous material has a thickness which is less than the free mean free path of an electron in said porous material.

2. The tunnel diode of claim 1 in which said porous material comprises porous silicon.

3. The tunnel diode of claim 1 in which said porous material comprises doped porous silicon.

4. The tunnel diode of claim 1 in which said thickness is in the range of 1 to 100 nm.

5. The tunnel diode of claim 1 additionally comprising a heat source in contact with said emitter electrode.

6. The tunnel diode of claim 1 additionally comprising a heat sink in contact with said collector electrode.

7. Apparatus for the conversion of energy comprising:

- (a) a source of energy;
- (b) an emitter electrode connected to said source of energy;
- (c) a collector electrode;
- (d) a porous material disposed between said emitter electrode and said collector electrode;

(e) an electrical circuit connecting said electrodes; and  
wherein said porous material has a thickness which is less than the free mean free path of an electron in said porous material.

8. The apparatus of claim 7 in which said porous material comprises porous silicon.

9. The apparatus of claim 7 in which said porous material comprises doped porous silicon.

-7-

10. The apparatus of claim 7 in which said thickness is in the range of 1 to 100 nm.
11. The apparatus of claim 7, wherein the conversion of energy is the conversion of thermal energy to electrical energy, wherein said source of energy comprises a source of thermal energy, and wherein said apparatus further comprises:
- a) a first thermal interface thermally connecting said source of energy to said emitter electrode;
  - b) a second thermal interface thermally connecting a heat sink means to said collector electrode;
  - c) an electrical load, electrically connected by said circuit between said collector electrode and said emitter electrode.
12. The apparatus of claim 11 wherein said source of thermal energy is of solar origin.
13. The apparatus of claim 7, wherein the conversion of energy is the conversion of electrical energy to heat pumping capacity, and wherein said apparatus further comprises:
- a) a heat source and a heat sink, wherein said heat source is thermally connected to said emitter electrode and said heat sink is thermally connected to said collector electrode, and,
  - b) an electrical power supply, electrically connected by said circuit between said collector electrode and said emitter electrode for applying a voltage bias to said electrodes, said electrical power supply providing said energy source.
14. The apparatus of claim 13 wherein said heat source may be cooler than said heat sink.